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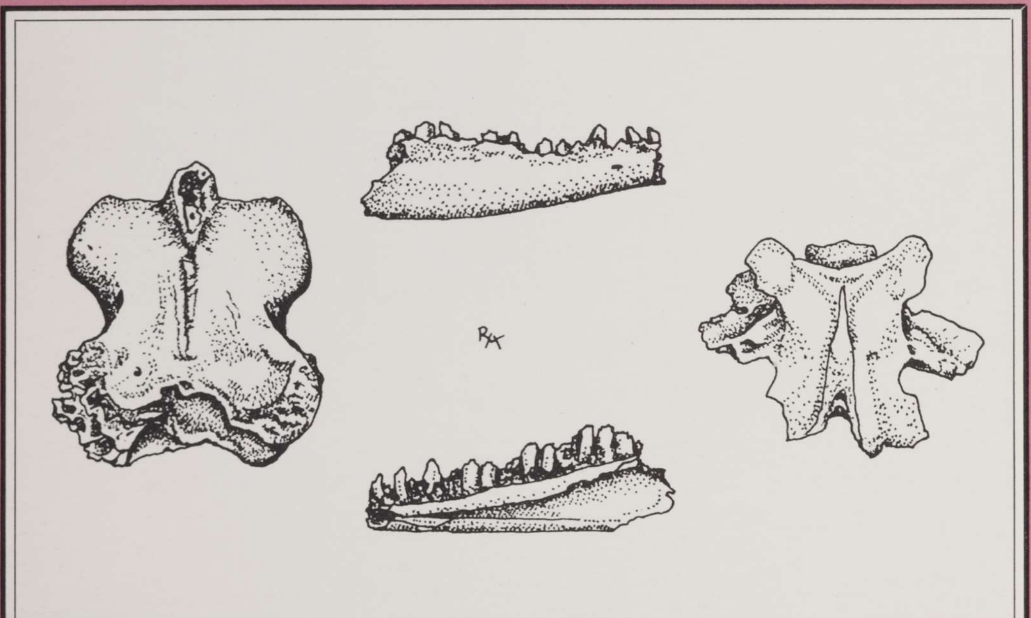
A MID-PLEISTOCENE (IRVINGTONIAN) HERPETOFAUNA

FROM A CAVE IN SOUTHCENTRAL TEXAS

J. Alan Holman
Alisa J. Winkler



MARCH 1987
TEXAS MEMORIAL MUSEUM, THE UNIVERSITY OF TEXAS AT AUSTIN

Pearce-Sellards Series

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J. Alan Holman, Curator of Vertebrate Paleontology, Michigan State University Museum, East Lansing, Michigan.

Alisa J. Winkler, Shuler Museum of Paleontology, Southern Methodist University, Dallas, Texas.

Editor - Georg Zappler
Layout, Typesetting - Mariah Mayfield

The Pearce-Sellards Series is an occasional, miscellaneous series of brief reports of Museum and Museum-associated field investigations and other research. All manuscripts are subjected to extramural peer review before being accepted. The series title commemorates the first two directors of Texas Memorial Museum, both now deceased: Dr. J. E. Pearce, Professor of Anthropology, and Dr. E. H. Sellards, Professor of Geology, The University of Texas at Austin.

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ABSTRACT

At least 24 species of amphibians and reptiles are identified from the mid-Pleistocene Fyllan Cave fauna. Travis County, Texas. This is the largest mid-Pleistocene herpetofauna known from Texas, and one of the largest mid-Pleistocene herpetofaunas known from the United States. Only the large terrestrial tortoise (*Geochelone* sp.) represents an extinct species, but three extralimital forms indicate that winters in the area were milder than they are today. The fossils appear to have been subjected to considerable post-mortem transport.

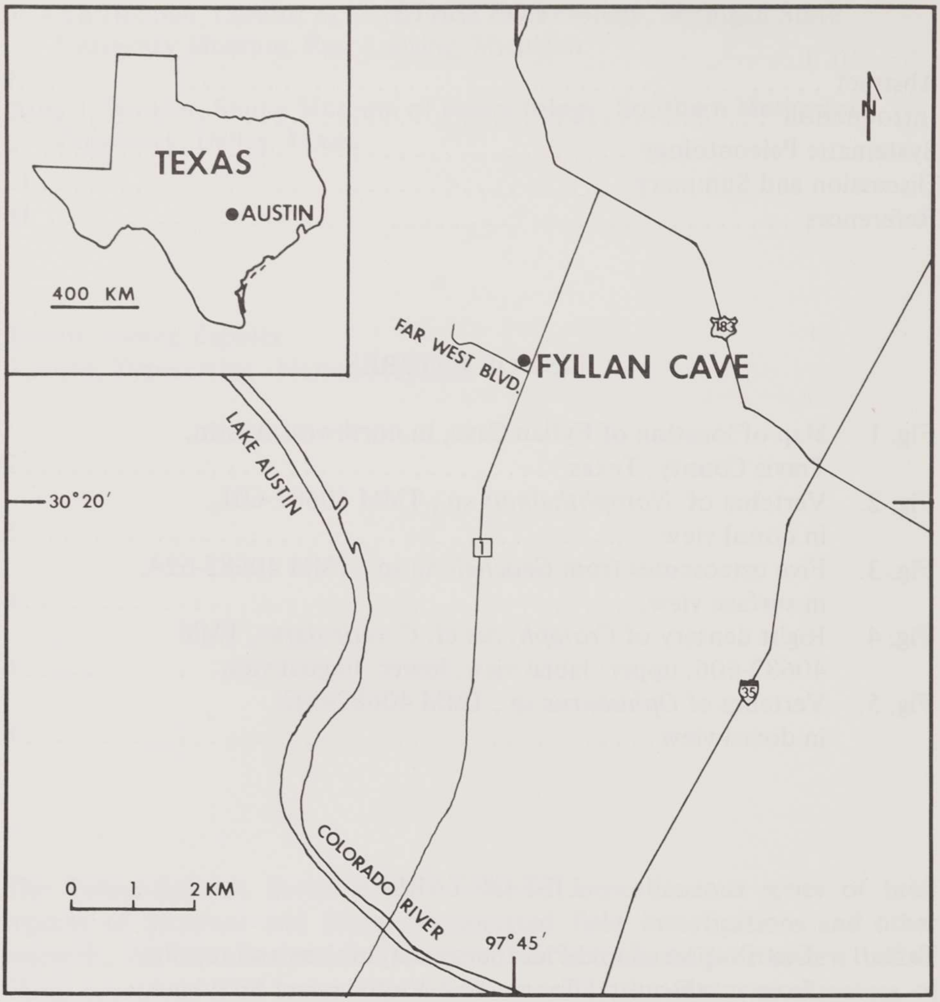

Fig. 1.–Location of Fyllan Cave in northwest Austin, Travis County, Texas.

INTRODUCTION

Although herpetofaunas from Rancholabrean sites in North America are well known (Lundelius et al., 1983), amphibians and reptiles from the Irvingtonian Land Mammal "Age" are comparatively rare (Holman, 1980). Mid-Pleistocene faunas from Texas are of special interest because some include southern extralimital forms, such as alligators and very large land tortoises of the genus *Geochelone.* However, only three of these Texas herpetological sites have been described, and these all have had fewer than 10 identified species (Holman, 1980). These sites are Seymour Formation Locality UN–TL–58, Knox County (Chantell, 1966; Hibbard, 1960; Holman, 1965; and Tihen, 1960), the Gilliland local fauna, Knox County (Hibbard and Dalquest, 1966; Hibbard, 1960; and Preston, 1979), and the Rock Creek local fauna, Briscoe County (Hibbard and Dalquest, 1966).

Winkler (Taylor, 1982) studied a fossil fauna from Fyllan Cave, Travis County, Texas. This cave (Fig. 1) has yielded about 40 species of mammals indicating a mid-Pleistocene (Irvingtonian) age for the deposit. Matrix samples from Fyllan Cave were reversely magnetized; in conjunction with the mammalian fossils, this suggests deposition near the end of the Matuyama reversed polarity chron. The mammalian remains, geology, and stratigraphy are currently under study (Winkler, in preparation). Fyllan Cave has also yielded a herpetofauna of at least 24 species, providing an unprecedented opportunity to view the herpetological life of the mid-Pleistocene of Texas.

Fyllan Cave (locality number TMM 40682) lies in Travis County, Texas, at about 30 degrees 21 minutes N. Lat., 97 degrees 45 minutes W. Long. The Fyllan Cave sediments occur in a small solution feature about 2.1 meters in maximum length, 1.29 meters in height, and one meter in depth. These sediments can be divided into three main stratigraphic units: an upper and lower mudstone unit, and a middle unit of dense limestone. The identified herpetological remains described here came from gravel lags within the lower and middle units.

Rosemarie Atillio made the drawings of the specimens. The system of classification used follows Dowling and Duellman (1978). The specimens are in Texas Memorial Museum (TMM) in Austin, Texas.

SYSTEMATIC PALEONTOLOGY

Class Amphibia

Order Caudata

Family Salamandridae

Notophthalmus sp.

Material.—A single vertebra, TMM 40682-601 (Fig. 2), Lower Unit.

Remarks.—The vertebrae of the genus *Notophthalmus* have a very characteristic high, posteriorly thick, and posteriorly divided neural spine. The single vertebra is unquestionably *Notophthalmus,* but we are unable to identify it to species. The genus does not occur in the area today. *Notophthalmus meridianalis* reaches the southern tip of Texas from its range in eastern Mexico about 161 kilometers south of the fossil locality (Conant, 1975, map 199). *Notophthalmus viridescens,* a widespread species of the eastern United States, occurs about 129 kilometers east of the fossil locality, although there is a questionable record about 80 kilometers due south (Conant, 1975, map 198).

Family Ambystomatidae

Ambystoma tigrinum Green

Material.—Seven vertebrae and one left humerus, TMM 40682-604, Lower Unit.

Remarks.—The vertebrae are identified as *Ambystoma tigrinum* using characters of Rogers (1982, p. 175) who summarized characters of Tihen (1958) and Holman (1971). The femur of *A. tigrinum* also appears to be rather diagnostic in that it is (1) larger than any other species of *Ambystoma,* (2) has the crista ventralis about as massive as the head (terminology of Wilder, 1903, plate 65), and (3) has a well-developed intercondylar depression in lateral view. This species occurs in the area today (Conant, 1975, map 205).

Order Anura

Family Bufonidae

Bufo sp.

Material.—Sacral vertebra and right ilium, TMM 40682-605, Lower Unit.

Remarks.—These elements are assigned to the genus *Bufo* on the basis of characters in Tihen (1962). Unfortunately they are too water worn and fragmentary to assign to the specific level. Several species of *Bufo* occur in the vicinity of the fossil site today.

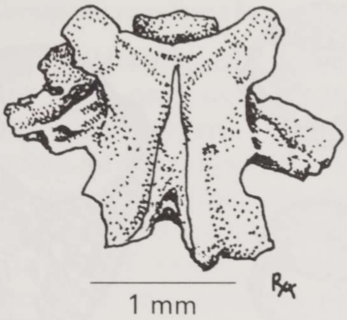

Fig. 2.—Vertebra of *Notophthalmus* sp., TMM 40682-601, in dorsal view.

Class Reptilia

Order Testudines

Family Kinosternidae

Kinosternon flavescens (Agassiz)

Material.—Nuchal bone, TMM 40682-603, Middle Unit.

Remarks.—The genus *Kinosternon* may be separated from the genus *Sternotherus* on the basis of the nuchal bone: in *Kinosternon* the pleural scutes overlap considerably less area of the nuchal bone than in *Sternotherus* (see Preston, 1979, p. 26, fig. 4a, c, and d). *Kinosternon flavescens* appears to be different from *K. subrubrum* in that the medial margins of the pleural scutes do not intersect the first marginal scutes anteriorly as in *K. subrubrum.* The Fyllan Cave nuchal resembles *K. flavescens* in this character. *Kinosternon flavescens* occurs in the area today (Conant, 1975, map 10).

Family Testudinidae

Geochelone, large species

Material.—Five osteoscutes, TMM 40682-624 (Fig. 3), Lower Unit.

Remarks.—These osteoscutes are from the limb armor. They are somewhat water-worn, but can be matched with osteoscutes of similar sizes and shapes from very large land tortoises such as *Geochelone orthopygia.*

The presence of large land tortoises of the genus *Geochelone* is an important indication that the winter climate was quite mild, with temperatures seldom if ever reaching freezing (Hibbard, 1960, and many subsequent authors).

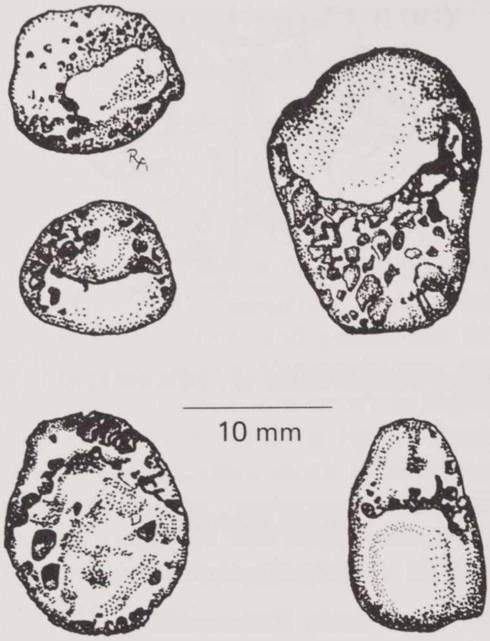

Fig. 3.–Five osteoscutes from *Geochelone* sp., TMM 40682-624, in surface view.

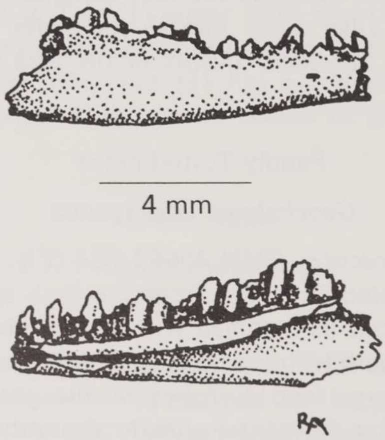

Fig. 4.–Right dentary of *Crotaphytus* cf. *C. reticulatus*, TMM 40682-606, upper: labial view; lower: lingual view.

Terrapene carolina (Linnaeus)

Material.—Entoplastron, TMM 40682-611, Lower Unit.

Remarks.—A character based on a series of 30 **T. carolina** and 24 *T. ornata,* but overlooked by many workers, appears to readily separate the entoplastra of the two species. In *T. carolina* the gular scutes encroach much less farther posteriorly on the entoplastron than they do in *T. ornata*; usually one-third or less the distance to the humeral scute in *T. carolina,* and one-half or more this distance in *T. ornata.* The fossil entoplastron appears to be identical to *T. carolina* in this aspect. A peripheral bone from the Middle Unit (TMM 40682-626) is assigned to *Terrapene* sp. Today, *T. carolina* barely reaches the area from the east (Conant, 1975, map 28).

Order Squamata

Suborder Sauria

Family Iguanidae

Crotaphytus cf. *Crotaphytus reticulatus* Baird

Material.—Right dentary, TMM 40682-606 (Fig. 4), Lower Unit.

Remarks.—The dentary of *Crotaphytus reticulatus* differs strongly from that of *Gambelia wislezeni* in that both the bone and the teeth are much less gracile. Moreover, the posterior teeth of *C. reticulatus* are lower, blunter, and less distinctly tricuspid than in *G. wislezeni.* The dentary of *C. reticulatus* is similar to that of *C. collaris* in dentary shape and in tooth structure, but it is distinguishable (Etheridge, 1958, p. 97). The dentary of *C. reticulatus* has the Meckelian groove closed anterior to the splenial for a space of about four teeth, and has only three mental foramina. The Fyllan Cave fossil dentary has this groove closed for a space of four teeth, and only one mental foramen can be observed as the end of the fossil dentary is broken. Nevertheless, it appears certain that the maximum number of foramina that could have been present in the unbroken fossil would have been three.

Today, *C. reticulatus* occurs about 160 kilometers to the southwest of the fossil locality (Conant, 1975, map 152). This is the first fossil record of *C. reticulatus.*

Sceloporus near *Sceloporus olivaceus* Smith

Material.—Left dentary, TMM 40682-609, Lower Unit.

Remarks.—*Sceloporus olivaceus* has teeth that are lower-crowned and more robust than those of *S. undulatus* and *S. variabilis,* but more gracile and higher-crowned than those of *S. poinsetti* and *S. cyanogenys.* The fossil seems to be similar to dentaries of *S. olivaceus,* a lizard that occurs in the area today (Conant, 1975, map 69).

Sceloporus near *Sceloporus undulatus* Latreille

Material.—Posterior portion of left dentary, TMM 40682-608, Lower Unit.

Remarks.—The teeth in this section of the dentary are similar to those of *S. undulatus* and differ from those of *S. olivaceus, S. poinsetti,* and *S. cyanogenys* in being higher-crowned and more gracile. This part of the dentary has less distinctly tricuspid teeth than in *S. variabilis.* The fossil is thus assigned to *S.* near *S. undulatus. Sceloporus undulatus* occurs in the area today (Conant, 1975, map 72).

Family Scincidae

Eumeces fasciatus (Linnaeus)

Material.—Two left and one right dentaries, TMM 40682-610, Lower Unit.

Remarks.—Three dentaries represent a small skink and are easily assignable to *Eumeces fasciatus. Eumeces fasciatus* differs from two other small skinks in the general region today, *E. septentrionalis* and *E. tetragrammus,* as follows: (1) larger, (2) lingual shelf stronger and wider, (3) teeth more robust, tips more bevelled, less pointed, and (4) about six teeth rather than about ten in *E. septentrionalis* and about nine in *E. tetragrammus* anterior to the anterior closure of the Meckelian groove. *Eumeces fasciatus* occurs in the area today (Conant, 1975, map 75).

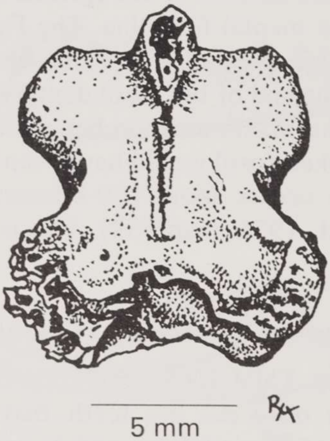

Fig. 5.—Vertebra of *Ophisaurus* sp., TMM 40682-602, in dorsal view.

Eumeces obsoletus (Baird and Girard)

Material.—Right dentary, TMM 40682-607, Middle Unit.

Remarks.—This dentary represents a very large skink such as *Eumeces obsoletus* or *E. laticeps,* both of which are much larger than other species of *Eumeces* east of the Continental Divide. The teeth of *E. obsoletus* are lower-crowned and less gracile than those of *E. laticeps*; the fossil resembles *E. obsoletus* in this character. Today, *E. obsoletus* is almost exactly at the eastern edge of its range in the area of the deposit (Conant, 1975, map 79).

Family Anguidae

Ophisaurus sp.

Material.—Two vertebrae, TMM 40682-602 (Fig. 5), Middle Unit.

Remarks.—Etheridge (1961) attempted to distinguish vertebrae of the species of *Ophisaurus* on the basis of vertebral proportions expressed as ratios. Since the neural spines of both of the Fyllan Cave fossils are broken, some of these proportions cannot be used. A ratio obtained by dividing the length of the centrum (as measured from the greatest depth of the glenoid cavity of the cotyle to the most posterior extent of the condyle) by the least width of the neural arch has been used to separate the modern species of *Ophisaurus*. This ratio in the measurable Fyllan Cave specimen is 1.44 (3.2 mm divided by 4.6 mm) which does not distinctly separate it from *O. compressus* (1.5–2.0) and *O. attenuatus* (1.1–1.4), although it does fall within the range of *O. ventralis* (1.12–1.55). Since the second *Ophisaurus* vertebra has the posterior tip of the centrum broken as well as the end of the neural spine, none of Etheridge's ratios are obtainable. This vertebra represents a very large glass lizard, one that might easily have been larger than any recorded living North American specimen. The greatest length of this vertebra through the zygapophyses is 10.0 mm. A modern *O. ventralis* in the Michigan State University Museum collections with a total length of 57.8 cm has a greatest vertebral length through the zygapophyses of 5.3 mm. The Fyllan Cave specimen indicates an animal even larger than an adult *Ophisaurus apodus* (southeastern European) specimen in the Michigan State University Museum collections. This *O. apodus* specimen has a total length of 95.5 cm, and has a greatest length through the zygapophyses of a mid-body vertebra of only 7.7 mm. By projection, the Fyllan Cave specimen must have had a total length of 117 or more cm.

It seems that this material may represent a distinct, very large form of *Ophisaurus,* but more fossil material would be needed to be certain. *Ophisaurus attenuatus* occurs in the area today, where it reaches the western limits of its distribution (Conant, 1975, map 97).

Suborder Serpentes

Family Colubridae

Subfamily Xenodontinae

Tantilla sp.

Material.—Two trunk vertebrae, TMM 40682-622, Middle Unit.

Remarks.—These tiny vertebrae are assignable to the genus *Tantilla* on the basis of their tiny size, obsolete neural spines, and the lack of a narrow, distinct, hemal keel; but, we are unable to determine the species represented. *Tantilla gracilis* is the only species of the genus in the area today (Conant, 1975, map 169).

Subfamily Colubrinae

Coluber or *Masticophis*

Material.—Six trunk vertebrae, TMM 40682-617, Lower Unit.

Remarks.—These vertebrae represent either *Coluber* or *Masticophis* or both, but they are so worn and fragmentary that they cannot be assigned to either genus with certainty. Both genera occur in the area today (Conant, 1975, maps 139, 140, and 141).

Elaphe guttata (Linnaeus)

Material.—Four trunk vertebrae, TMM 40682-625, Lower Unit.

Remarks.—Auffenberg (1963) has discussed the identification of species of *Elaphe* on the basis of individual vertebral remains. The subspecies *Elaphe guttata emoryi* occurs in the area today (Conant, 1975, map 150).

Lampropeltis getulus (Linnaeus)

Material.—Nine trunk vertebrae, TMM 40682-618, Lower Unit.

Remarks.—Auffenberg (1963) discussed the identification of this species on the basis of individual vertebrae. *Lampropeltis getulus* occurs in the area today (Conant, 1975, map 156).

Lampropeltis triangulum (Lacepede)

Material.—One trunk vertebra, TMM 40682-616, Lower Unit.

Remarks.—Auffenberg (1963) and Holman (1980) discussed the vertebral characters that readily separate *Lampropeltis triangulum* from other related forms. The Fyllan Cave vertebra represents a large specimen, probably one about 95 cm in length. Conant (1975, p. 208 and map 153) reports that *Lampropeltis triangulum annulata*, which occurs in the area today, reaches a maximum length of 99 cm.

Subfamily Natricinae

Nerodia fasciata (Linnaeus)

Material.—Trunk vertebra, TMM 40682-621, Lower Unit.

Remarks.—The trunk vertebrae of *Nerodia fasciata* are more elongate than those of *N. rhombifera* and *N. erythrogaster.* The Fyllan Cave vertebra is assignable to *N. fasciata,* a species that reaches the westernmost limits of its distribution in the area today (Conant, 1975, map 100).

Storeria sp.

Material.—Four trunk vertebrae, TMM 40682-619, Lower Unit.

Remarks.—These small natricine vertebrae are separable from those of *Virginia* in having slightly higher neural spines, but are too fragmentary to assign to the species level. The only species of this genus that occurs in the area today is *Storeria dekayi* (Conant, 1975, map 128).

Thamnophis sp.

Material.—Trunk vertebra, TMM 40682-620, Lower Unit.

Remarks.—This vertebra has the elongate vertebral shape of *Thamnophis sirtalis* and *T. proximus,* and thus differs from the shorter vertebrae of *T. radix* and *T. marcianus.* We are unable to assign it to species. Both *T. sirtalis* and *T. proximus* occur in the area today (Conant, 1975, maps 116 and 120).

Tropidoclonion lineatum (Hallowell)

Material.—Two trunk vertebrae, TMM 40682-612, Lower Unit.

Remarks.—This is only the third record of this genus and species as a fossil. It has previously been reported from the Pleistocene (Irvingtonian) of Texas and Kansas (Holman, 1965 and 1971). Holman (1965) gives vertebral characters for this distinctive small form. The species occurs in the area today (Conant, 1975, map 123).

Family Elapidae

Micrurus fulvius (Linnaeus)

Material.—Two trunk vertebrae, TMM 40682-623, Lower Unit.

Remarks.—These elongate vertebrae, with their very low to obsolete neural spines and posteriorly projecting hypapophyses, appear identical to those of modern *Micrurus fulvius,* a species that occurs in the area today (Conant, 1975, map 175).

Family Viperidae

Crotalus atrox Baird and Girard

Material.—Trunk vertebra, TMM 40682-613, Lower Unit; and trunk vertebra, TMM 40682-614, Middle Unit, questionably referred.

Remarks.—It appears that many of the large species of *Crotalus* may be separated from one another on the basis of the height and shape of the neural spine. *Crotalus adamanteus* has the highest neural spine of any *Crotalus* that we have observed. *Crotalus atrox* and *C. mollosus* have neural spines that are higher than long, but *C. atrox* has a somewhat lower spine than *C. mollosus. Crotalus atrox* also has a neural spine with more of a posterior overhang than does *C. mollosus.* Vertebrae of *C. viridis* have neural spines about as high as long, and in *C. horridus* the neural spines are longer than high. The fossil TMM 40682-613 resembles *C. atrox* in both the height and the shape of the neural spine. Based on comparative specimens in the Michigan State University Museum collections, this vertebra represents a specimen about 122 cm in length. The fossil TMM 40682-614 is assigned to *Crotalus* cf. *C. atrox* based on its large size. It represents a specimen that was about 150 cm in total length. *Crotalus atrox* occurs in the area today (Conant, 1975, map 183).

Crotalus horridus Linnaeus

Material.—Trunk vertebra, TMM 40682-615, Middle Unit.

Remarks.—This vertebra has the low, long neural spine characteristic of *Crotalus horridus* as discussed in the previous section. The subspecies *C. horridus atricaudatus* occurs in the area today (Conant, 1975, map 178).

DISCUSSION AND SUMMARY

The Fyllan Cave herpetofauna is the most taxonomically diverse mid-Pleistocene (Irvingtonian) herpetofauna known from Texas and one of the most diverse known from the United States. At least two salamanders, one anuran, three turtles, six lizards, and twelve snakes are represented by the fossils. Of these 24 forms, one (*Geochelone* sp.) represents an extinct species, and three (*Geochelone* sp., *Notophthalmus* sp., and *Crotaphytus* cf. *C. reticulatus*) are not found in the area today.

Taylor (1982) points out that the Fyllan Cave mammalian fauna is most similar to those from the lower levels of the late Kansan Trout Cave local fauna of West Virginia and the Cumberland Cave local fauna of Maryland. It is significant that the herpetofaunas of these sites reflect modern regional distribution patterns (Table 1) more strongly than the mammals (Winkler, in preparation).

Table 1.—Distribution of mid-Pleistocene amphibians and reptiles from south-central Texas, West Virginia, and Maryland. An asterisk indicates extralimital species. An E indicates an extinct species.

Taxon	Fyllan Cave, Texas	Trout Cave, West Virginia	Cumberland Cave, Maryland
Cryptobranchus guildayi (E)		x	x
Ambystoma maculatum			x
Ambystoma opacum		x	x
Ambystoma tigrinum	x	x	x (*)
Notophthalmus viridescens			x
Notophthalmus sp.	x (*)		
Plethodon glutinosus			x
Gyrinophilus porphyriticus			x
Pseudotriton ruber			x
Bufo americanus		x	x
Bufo woodhousei fowleri			x
Bufo sp.	x		
Hyla crucifer			x
Pseudacris triseriata			x
Rana clamitans			x
Rana sylvatica		x	x
Rana pipiens		x	x
Kinosternon flavescens	x		
Geochelone sp. (E)	x (*)		
Clemmys muhlenbergi			x
Terrapene carolina	x		x
Chrysemys picta			x
Crotaphytus cf. *C. reticulatus*	x (*)		
Sceloporus near *S. olivaceus*	x		
Sceloporus undulatus		x	x
Sceloporus near *S. undulatus*	x		
Eumeces fasciatus	x	x	x
Eumeces obsoletus	x		
Ophisaurus sp.	x		
Coluber or *Masticophis*	x		
Coluber constrictor		x	x
Elaphe guttata	x		
Elaphe vulpina		x (*)	x (*)
Lampropeltis getulus	x		
Lampropeltis triangulum	x	x	x
Opheodrys vernalis			x
Heterodon platyrhinos		x	x
Diadophis punctatus			x
Carphophis amoenus			x
Tantilla sp.	x		
Nerodia fasciata	x		
Storeria sp.	x		
Thamnophis sp.	x	x	x
Tropidoclonion lineatum	x		
Micrurus fulvius	x		
Agkistrodon contortrix		x	
Crotalus atrox	x		
Crotalus horridus	x	x	x
Sistrurus catenatus		x (*)	

The extralimital herpetological forms in the mid-Pleistocene Trout Cave and Cumberland Cave local faunas (*Elaphe vulpina* and *Sistrurus catenatus*) are those that have encroached from grasslands to the west, possibly following a "Prairie Peninsula" (Holman, 1977 and 1982). The extralimital forms in the Fyllan Cave fauna (*Notophthalmus* sp., *Geochelone* sp., *Crotaphytus* cf. *C. reticulatus*) probably reflect species responding to warmer winter climates in the area than at present, a subject that will be discussed in more detail later in this section.

The Fyllan Cave herpetofauna strikingly reflects the "ecotonal" aspect of the area today which lies at the junction of the Texas and Balconian Biotic Provinces, and rather near the Tamaulipan Biotic Province (Blair, 1950; Holman, 1969). The Fyllan Cave amphibian and reptile fauna, like the modern fauna, reflects the convergence of eastern and western species, with the addition of at least two and possibly three southern species. Forms with their main distribution to the east today are: *Notophthalmus* sp. (possibly to the south, if *N. meridionalis* rather than *N. viridescens* is represented), *Terrapene carolina, Eumeces fasciatus, Ophisaurus* sp., *Lampropeltis triangulum, Nerodia fasciata, Storeria* sp., *Micrurus fulvius,* and *Crotalus horridus.* Forms with their main distribution to the west today are: *Kinosternon flavescens, Sceloporus* near *S. olivaceus, Eumeces obsoletus,* and *Crotalus atrox.* Forms that are of such widespread distribution today and/or whose identification did not proceed far enough to allow geographic interpretation are: *Ambystoma tigrinum, Bufo* sp., *Sceloporus* near *S. undulatus, Coluber* or *Masticophis, Elaphe guttata, Lampropeltis getulus,* and *Tantilla* sp. The southern extralimital species are: *Notophthalmus* sp. (if *N. meridionalis* rather than *N. viridescens* is represented), *Geochelone* sp., and *Crotaphytus* cf. *C. reticulatus.*

One of the most widely discussed aspects of North American Pleistocene faunas is that many of them are considered to be "disharmonious" assemblages (Lundelius et al., 1983). This term is used to refer to faunas with animals that would be "ecologically incompatible" today (term of Holman, 1976). In such an assemblage, one cannot find an area on the map where all of the species identified could be found living today ("area of sympatry" of McMullen, 1975). I (Holman, 1980) have used the term "extralimital", and we use it here to refer to Pleistocene species that occur outside their present ranges. The amount of "disharmoniousness" in faunas varies considerably; some having only one or two extralimital forms that are not far out of their present ranges, while others may have several extralimital forms far out of their present ranges, with even Boreal and Tropical forms occurring together. Disharmonious herpetofaunas may be found in both glacial and interglacial sites (Holman, 1980).

An explanation for these disharmonious faunas in the North American Pleistocene (Lundelius et al., 1983) is contained in a "Pleistocene Climatic Equability Model." This term grew out of the concept of Hibbard (1960), and many subsequent authors, that cooler summers account for the presence of northern extralimital species in the fauna, and that warmer winters account for the presence of southern extralimital species in the fauna. The classic concept that glaciers "pushed" some northern forms down into southern communities may be true, but this does not fully explain the presence of southern extralimital forms.

Some amphibians and reptiles are important in reconstructing fossil communities and paleoclimates. This is because most herpetological Pleistocene species are living today, and being ectotherms, they may be quite sensitive to ecological change. For this reason the Fyllan Cave herpetofauna is of interest because, aside from the extinct *Geochelone* sp., the herpetofauna is quite similar to todays regional fauna. The only forms which have extralimital modern representatives are *Notophthalmus* sp. and *Crotaphytus* cf. *C. reticulatus.* The former occurs within 80 to 130 km, and the latter within 160 km of the fossil site. None of the Fyllan Cave amphibian and reptile species indicates that the climate was any cooler than at present, but the presence of *Geochelone* sp. and *Crotaphytus* cf. *C. reticulatus* is diagnostic of warmer winters. Large *Geochelone* could not have been able to survive the cold fronts that sweep into Texas today from the northern prairies (Hibbard, 1960, and subsequent authors). One might envision a climate similar to that of the area at present, but with the absence of winter cold fronts.

The Fyllan Cave herpetofauna indicates the occurrence of considerable post-mortem transport. This conclusion is based on (1) the extreme water wear on most of the fossils, (2) the preponderance of terrestrial forms in the fauna, and (3) the virtual absence of species that would have lived in or near the immediate vicinity of the cave.

Most of the fossil bones are very water-worn and unidentifiable. The most recognizable of these are large snake bones (possibly *Crotalus atrox*) and turtle shell fragments. Most of the identifiable bones were quite small, usually less than five mm in length. It is logical that the large denser bones should undergo much more wear than the tiny, less dense, more easily transportable bones (La Duke, 1983).

Only four of the 24 herpetological forms are aquatic or semiaquatic. These are: *Notophthalmus* sp. and *Bufo* sp. (for a small part of their life cycles), *Kinosternon flavescens* (which can occupy very ephemeral aquatic habitats), and *Nerodia fasciata.* The rest of the herpetofauna represents mainly terrestrial species that prefer mesophytic to xerophytic habitats.

Finally, there are no obligatory troglodytic species in the fauna, nor are there any species that would depend heavily on a cave environment. A possible exception is *Elaphe guttata*, a species that commonly enters caves to feed on bats (personal observation, J.A.H.). In summary, it appears that most of the Fyllan Cave herpetological fossils were transported from terrestrial sources.

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